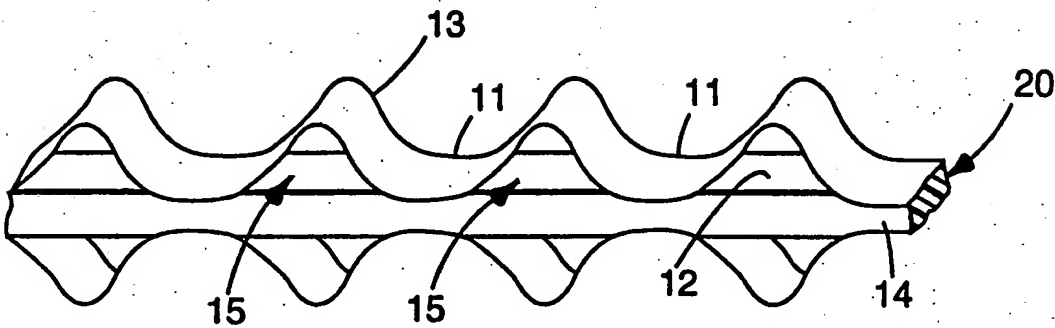




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<b>(21) International Application Number:</b> PCT/US93/05649 <b>(22) International Filing Date:</b> 14 June 1993 (14.06.93) <b>(30) Priority data:</b> 07/901,420 19 June 1992 (19.06.92) US <b>(71) Applicant (for all designated States except US):</b> MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only) :</b> SWENSON, Douglas, A. [US/US]; FOX, Herbert, J. [US/US]; KRUEGER, Dennis, L. [US/US]; LOCKRIDGE, Rochelle, L. [US/US]; HELMER, Pamela, E. [US/US]; Post Office Box 33427, Saint Paul, MN 55133-3427 (US).		<b>(74) Agents:</b> BOND, William, J. et al.; Office of Intellectual Property Counsel, Minnesota Mining and Manufacturing Company, Post Office Box 33427, Saint Paul, MN 55133-3427 (US).  <b>(81) Designated States:</b> AU, BR, CA, JP, KR, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> ELASTIC FILM LAMINATE    <b>(57) Abstract</b>  An elastic film is provided with non-elastic regions and elastic regions formed from a multi-layer film of an elastomeric layer and a relatively inelastic layer(s).		

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## ELASTIC FILM LAMINATE

5 FIELD OF THE INVENTION

The invention concerns elastomeric films and more specifically concerns an improved elastomeric laminate.

BACKGROUND

10 Elastomeric films have for some time been used and discussed in the literature with regard to their applications in disposable products, such as baby  
diapers and adult incontinent devices. These elastomeric webs or films are used primarily in the  
15 body hugging portions of garments. Many of these elastics are temperature-treated to provide for controlled elastic recovery. In diapers, for example, elastomeric bands are typically used in the waistband portions such as discussed in U.S. Pat. No. 4,681,580,  
20 issued to Reising et al., and Lash, U.S. Pat. No. 4,710,189. Both of these patents describe the use of elastomeric materials which have a heat stable and a heat unstable form. The heat unstable form is created by stretching the material when heated around its  
25 crystalline or second phase transition temperature followed by a rapid quenching to freeze in the heat unstable extended form. The heat unstable elastomeric film can then be applied to the, e.g., diaper and then heated to its heat stable elastomeric form.

30 Berger, U.S. Pat. 3,694,815, proposed a method for attaching a stretched relaxed elastic ribbon to a garment by stretching conventional elastic ribbons and immediately freezing the elastomeric material at relatively extreme low temperatures (e.g., well below  
35 ambient).

UK Pat. Application 2190406 A proposed maintaining a conventional elastomer in a stretched condition,

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while attaching it to the member to be shirred (e.g., a diaper), by a rigidifying member, which would then be removed or destroyed following the attachment procedure. As described, the elastomers are first  
5 stretched then applied to the rigidifying member in its stretched form.

Matray et al., UK Pat. 2,160,473, proposes an elastomer which will shrink at an elevated temperature (e.g., at or above 175°F or 79.4°C). The allegedly  
10 novel feature of this material, compared to the heat shrink materials discussed above, is that it does not require preheating or cold treatment during the stretching operation but rather could be stretched at ambient temperatures by a differential speed roll  
15 process or by "cold rolling". The polymer proposed was a copolymer having alternating segments of polyamidepolyether block polymers, commercially available under the trade name Pebax, particularly Pebax Extrusion grades 2533 and 3533.

20 Problems with these elastomeric films include the difficulties inherent in applying a stretched elastic film to a flexible substrate such as a disposable diaper. For example, these film elastics, after being attached to a flexible substrate, such as by adhesives,  
25 will place shear stresses on the attachment areas. This can result in the elastic detaching from the flexible substrate, particularly after repeated elongations.

In copending PCT Application No. US90/05783, filed  
30 10/10/90 (WO 91/107277, published 30 May 1991), having a common assignee, there is disclosed an elastomeric laminate having at least one elastomeric layer and at least one skin layer which addresses some of the above-noted problems in the art.

35 Despite the numerous advantages in the materials of the copending application, there is room for improvement for some applications. In order to

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activate the nonelastomeric laminate into a state that will allow it to recover and become elastomeric, the laminate must be stretched a substantial amount, for many materials contemplated as useful for the skin and core layers. Further, when the elastic is applied to a garment, equally high stretch ratios are generally required to provide sufficient elastic force to functionally elasticize the garment. This is problematic for applications where low elastic stretch ratios would be desirable, for example, when high levels of gathering of a garment is undesirable or where required by manufacturing needs. There is also a need for elastics that will provide elasticity only in specified areas without requiring the application of separate discrete elastic elements at each area.

The desirability of obtaining elasticity in specified areas of a ribbon or tape-like substrate is illustrated by U.S. Patent Nos. 3,800,796, 4,834,820, 4,778,701 and 4,227,952, which disclose the use of composite materials designed to have specified areas of elasticity for use in diaper systems. However, these composites require complicated construction mechanisms to bring the diverse elements of the composite together and/or special procedures for their manufacture and use, that limit their general applicability.

#### SUMMARY OF THE INVENTION

The present invention relates to improved non-tacky, microtextured, multi-layer elastomeric laminates. The laminates of the present invention are comprised of an elastomeric polymeric core layer(s), which provides elastomeric properties to the laminate and one or more polymeric skin layers. Laminates can be prepared by coextrusion of the selected polymers for the skin and core layers or by application of one or more elastomer layer(s) onto one or more already formed skin layer(s). The novel, non-tacky microtextured

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laminate is obtained by stretching the laminate past the elastic limit of the skin layers and, while the laminate is stretched, selectively deactivating the elasticity of the laminate at predetermined regions.

5 The laminate then recovers, in the non-deactivated regions, which can be instantaneous, over an extended time period, which is skin layer controllable, or by the application of heat, which is also skin layer controllable.

10 The selectively deactivated areas provide high-strength inelastic regions. The recovered regions can be microtextured or have detached skin layers.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 Fig. 1 is a schematic representation of a process and apparatus used to coextrude the laminates of the invention.

Fig. 2 is the cross-sectional segment of a laminate with microstructuring caused by uniaxially stretching a film of the invention.

20 Fig. 3 is a perspective view of a microtextured skin embodiment of the invention.

Fig. 4 is a perspective view of a delaminated skin embodiment of the invention.

25 Fig. 5 is a diaper tape tab formed of the invention laminate.

Fig. 6 is an end view of the Fig. 4 embodiment as it would appear in a diaper.

Fig. 7 is a perspective view of a delaminated skin embodiment as in Fig. 4 laminated to a nonwoven having a large central nonelastic region such as would be suited as a disposable training pant with elastic side panels.

Fig. 8 is a plan view of a laminate such as in Fig. 7 having a large central nonelastic region.

35 Fig. 9 is an alternative embodiment of Fig. 8 having nonelastic outer edge regions.

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Fig. 10 is a perspective view of a training pant using the laminate of the invention as an outer cover sheet.

Fig. 11 is a top view of a training pant using the  
5 laminate of the invention as an outer cover sheet.

Fig. 12 is a top view of an alternative embodiment of a training pant using the laminate of the invention as an outer cover sheet.

Fig. 13 is a perspective view of a resealable  
10 training pant using the laminate of the invention as an outer cover sheet.

Fig. 14 is a top view of the training pant of Fig. 13 in an open condition.

Fig. 15 is a perspective view of an alternative  
15 embodiment of a resealable training pant using the laminate of the invention as an outer cover sheet.

Fig. 16 is a top view of an alternative embodiment of Fig. 15 using the laminate of the invention as an outer cover sheet.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The present invention relates broadly to novel  
5 non-tacky, multi-layer elastomeric laminates comprising  
at least one elastomeric core layer and at least one  
relatively nonelastomeric skin layer. The skin  
layer(s) are stretched beyond their elastic limit and  
recovered in selected, non-deactivated, areas with the  
10 core layer so as to form elastic regions. Microtexture  
or microstructure means that the layer contains peak  
and valley irregularities or folds which are large  
enough to be perceived by the unaided human eye as  
causing increased opacity over the opacity of the  
15 laminate before microtexturing, and which  
irregularities are small enough to be perceived as  
smooth or soft to human skin. Magnification of the  
irregularities is required to see the details of the  
microtexture.

20 The elastomer can broadly include any material  
which is capable of being formed into a thin film layer  
and exhibits elastomeric properties at ambient  
conditions. Elastomeric means that the material will  
substantially resume its original shape after being  
25 stretched. Further, preferably, the elastomer will  
sustain only small permanent set following deformation  
and relaxation, which set is preferably less than 20  
percent and more preferably less than 10 percent of the  
original length at moderate elongation, e.g., about  
30 400-500%. Generally, any elastomer is acceptable which  
is capable of being stretched to a degree that causes  
relatively consistent permanent deformation in a  
relatively inelastic skin layer. This can be as low as  
50% elongation. Preferably, however, the elastomer is  
35 capable of undergoing up to 300 to 1200% elongation at  
room temperature, and most preferably up to 600 to 800%  
elongation at room temperature. The elastomer can be



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both pure elastomers and blends with an elastomeric phase or content that will still exhibit substantial elastomeric properties at room temperature.

Heat-shrink elastomers are contemplated for use in the present invention, however, non-heat-shrinkable elastomers can be used while retaining the advantages of heat shrinkability in selected embodiments. Non-heat-shrinkable means that the elastomer, when stretched, will substantially recover, sustaining only a small permanent set as discussed above.

Non-heat-shrinkable polymers include block copolymers such as those known to those skilled in the art as A-B or A-B-A block copolymers. These block copolymers are described, for example, in U.S. Patent Nos. 3,265,765; 3,562,356; 3,700,633; 4,116,917 and 4,156,673, the substance of which are incorporated herein by reference. Styrene/isoprene, butadiene or ethylene-butylene/styrene (SIS, SBS or SEBS) block copolymers are particularly useful. Other useful elastomeric compositions can include elastomeric polyurethanes, ethylene copolymers such as ethylene vinyl acetates, ethylene/propylene copolymer elastomers or ethylene/propylene/diene terpolymer elastomers. Blends of these elastomers with each other or with modifying non-elastomers are also contemplated.

Viscosity reducing polymers and plasticizers can also be blended with the elastomers such as low molecular weight polyethylene and polypropylene polymers and copolymers, or tackifying resins such as Wingtack<sup>TM</sup>, aliphatic hydrocarbon tackifiers available from Goodyear Chemical Company. Tackifiers can also be used to increase the adhesiveness of an elastomeric layer to a skin layer. Examples of tackifiers include aliphatic or aromatic hydrocarbon liquid tackifiers, polyterpene resin tackifiers, and hydrogenated tackifying resins. Aliphatic hydrocarbon resins are preferred.

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Additives such as dyes, pigments, antioxidants, antistatic agents, bonding aids, antiblocking agents, slip agents, heat stabilizers, photostabilizers, foaming agents, glass bubbles, reinforcing fiber, starch and metal salts for degradability or microfibers can also be used in the elastomeric core layer(s).

The skin layer can be formed of any semi-crystalline or amorphous polymer that is less elastic than the core layer(s) and will undergo permanent deformation at the stretch percentage that the elastomeric laminate will undergo. Therefore, slightly elastomeric compounds, such as some olefinic elastomers, e.g. ethylene-propylene elastomers or ethylene-propylene-diene terpolymer elastomers or ethylenic copolymers, e.g., ethylene vinyl acetate, can be used as skin layers, either alone or in blends. However, the skin layer is generally a polyolefin such as polyethylene, polypropylene, polybutylene or a polyethylene-polypropylene copolymer, but may also be wholly or partly polyamide such as nylon, polyester such as polyethylene terephthalate, polyvinylidene fluoride, polyacrylate such as poly(methyl methacrylate) (only in blends) and the like, and blends thereof. The skin layer material can be influenced by the type of elastomer selected. Skin-to-core layer contact in the Fig. 3 embodiment has been found to follow three modes; first, full contact between the elastomeric core layer and microtextured skin layer; second, full contact with cohesive failure of the core under the microtextured skin folds; and third, adhesive failure of the skin to the core under the microtexture folds with intermittent skin/core contact at the fold valleys.

The skin layer, preferably inelastic, used in conjunction with an elastomeric core layer will form at least one outer layer of the laminate. Used as either an outer or inner layer, the skin layer will modify the

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elastic properties of the elastomeric laminate when in contact with the elastomeric layer by any of the three above-described modes.

Additives useful in the skin layer include, but  
5 are not limited to, mineral oil extenders, antistatic agents, pigments, dyes, antiblocking agents, provided in amounts less than about 15%, starch and metal salts for degradability and stabilizers such as those described for the elastomeric core layer.

10 Other layers may be added between the core layer and the outer layers, such as interlayers to either increase or decrease the bonding of the skin and core layers. Tie layers can be formed of, or compounded with, typical compounds for this use including maleic  
15 anhydride modified elastomers, ethyl vinyl acetates and olefins, polyacrylic imides, butyl acrylates, peroxides such as peroxy polymers, e.g., peroxyolefins, silanes, e.g., epoxysilanes, reactive polystyrenes, chlorinated polyethylene, acrylic acid modified polyolefins and  
20 ethyl vinyl acetates with acetate and anhydride functional groups and the like, which can also be used in blends or as compatibilizers or delamination-promoting additives in one or more of the skin or core layers.

25 The shrink recovery mechanism of the laminate, after stretching and selective deactivation, depends on the conditions of film formation, the nature of the elastomeric layer(s), the nature of the skin layer(s), the manner in which the laminate film is stretched and  
30 the relative thicknesses of the elastomeric and skin layer(s). By controlling these variables, the laminate film can be designed to instantaneously recover, recover over time or recover upon heat activation.

Generally, the core-to-single skin layer ratio will be  
35 at least 3, preferably, at least 5 and less than about 100 and most preferably at least 5 to about 75. The overall laminate thickness will be at least 1 mil,

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preferably at least 2 mils, although preferably less than 10 mils for cost and performance considerations. At core-to-skin layer ratios less than 3, the laminate has a tendency to not recover when stretched. A

5 stretched and selectively deactivated laminate capable of instantaneous shrink is one in which the stretched, non-deactivated areas of the elastomeric laminate will recover more than 15% in 1 sec. A laminate capable of time shrink is one where the 15% recovery point takes

10 place more than 1 sec., preferably more than 5 sec., most preferably more than 20 sec. after stretch, and a laminate capable of heat shrink is where less than 15% shrink recovery occurs to the laminate in the first 20 seconds after stretch and will remain capable of heat

15 shrink for weeks after it is stretched. Percent recovery is the percent that the amount of shrinkage is of the stretched length minus the original length of the activated area. For heat-shrink laminates there will be an activation temperature which will initiate

20 significant heat-activated recovery. The activation temperature used for a heat-shrink laminate will generally be the temperature that will yield 50% of the total possible recovery ( $T_{.50}$ ) and preferably this temperature is defined as the temperature which will

25 yield 90% ( $T_{.90}$ ) of the total possible recovery. Total possible recovery includes the amount of preactivation shrinkage.

Generally, where the skin layer is relatively thin, the laminate will tend to contract or recover

30 immediately in the non-deactivated areas. When the skin thickness is increased sufficiently the laminate can become heat shrinkable in the non-deactivated regions or areas. This phenomenon can occur even when the elastomeric layer is formed from a non-heat

35 shrinkable material. By careful selection of the thicknesses of the elastomeric layer and the skin

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layer(s), the temperature at which the laminate recovers by a set amount can be controlled. This is termed skin controlled recovery, where generally by altering the thickness or composition of the skin, one  
5 can raise the elastic recovery activation temperature of an elastomeric core by a significant degree, generally more than at least 10°F (5.6°C) and preferably by 15°F (8.3°C) and more. Although any skin thickness which is effective can be employed, too thick  
10 a skin will cause the laminate to remain permanently set when stretched. Generally, where a single skin is less than 30% of the laminate this will not occur. For most heat or time shrink materials, the stretched non-deactivated regions of the elastomeric laminate must be  
15 cooled so that the energy released during stretching does not cause immediate heat activated elastic recovery. Fine tuning of the shrink recovery mechanism can be accomplished by the degree that the activated regions are stretched.

20 Improvements in the laminate structure of this invention over that of copending application USSN 07/438,593 lie in a laminate film having elastic properties at selected regions or zones separated by thin, non-elastic regions or zones. The elastic  
25 regions or zones are characterized by a microtextured surface on the skin layers or, in a preferred embodiment, a thin, skin layer selectively secured to the elastomeric layer in the thin non-elastic regions or zones (Fig. 4). In this preferred embodiment,  
30 detached skin layer material 13 in the elastic zones or regions 12 allows the elastomeric core layer 14 to recover uninhibited without the skin layer 13 effecting the elastic properties. However, the skin layer 13 provides a continuous unstressed attachment surface for  
35 securing the elastic 20 to substrates to be elasticized, without having to directly adhere the elastic to the substrates (Fig. 6). Conventional

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methods of securing stressed elastic directly to a substrate are problematic. An elastic under stress when attached to a substrate creates shear forces that can cause detachment of the elastic, stress relaxation of the elastic or reduction in elastic properties. The Fig. 4 elastic 20 is not directly attached to the substrate when it is under stress. The elastic 20 can be easily and securely attached to a substrate while avoiding the above-noted problems with conventional elastic. The preferred elastic 20 of Fig. 4 further provides a breathable securement due to channels 15, particularly useful in garment applications.

The non-elastic regions 11 are characterized by a smooth layer of oriented skin layer material secured to a reduced thickness elastomeric core layer 14. The elastomeric core layer 14 is unstressed in this non-elastic region 11 and generally thinner than the elastomeric layer 14 in adjacent recovered elastic regions or zones 12. These non-elastic regions 11 provide secure unstressed attachment points for the elastic laminate 10 or 20. The non-elastic regions 11 also provide reinforcement zones between the elasticized regions reducing the possibility of deformation of the elastic laminate, or attached substrates, when under stress.

In the Fig. 4 embodiment, the elastic laminate 20 can be continuously secured to a substrate by the skin layer 13. However, the elastic regions will be unattached and free to contract with its full elastic force when stretched. The secured skin layer, in both the elastic regions 12 and non-elastic regions 11, will keep the elastic in place and also serve as a reinforcement element for the substrate to which the elastic 20 is attached.

With the Fig. 3 embodiment, the elastic regions 12 will be microtextured tending to create a mechanical release layer. The elastic of this embodiment can

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therefore be applied to substrates with a uniform adhesive coating. The elastic regions will then preferentially detach, allowing the elastic to stretch and elastically recover, while remaining securely  
5 attached to the substrate in the non-elastic zones or regions 11.

A preferred mechanism for forming the film laminate by extrusion is shown in Fig. 1 where D, D' and D'' are feedblocks or manifolds. D, D' and D'' can  
10 be separate or combined, or a part of die E. E is a conventional multiple layer die or a combining adapter and die such as disclosed in U.S. Patent Nos. 4,152,387 or 4,197,069 (Cloeren). As shown, feedblocks or manifolds can be used to feed into each layer  
15 passageway of the multiple layer die E or to only a single passageway of such a die (e.g., with a combining adaptor in the feedblock region). AA, BB, and CC are extruders. AA', BB' and CC' are streams of thermoplastic material being extruded into the  
20 feedblocks or manifold die. E is the 3 or more layer (e.g., 5-layer) die, F is a heated casting roll, and G and H are rolls to facilitate take-off and roll-up of the laminate. Nip rollers can also be provided.

The die and feedblock used are typically heated to  
25 facilitate polymer flow and layer adhesion. The temperature of the die depends upon the polymers employed and the subsequent heat treatment steps. Generally the temperature of the die is not critical but temperatures are generally in the range of 350 to  
30 550°F (176.7 to 287.8°C) with the polymers exemplified.

Whether the laminate is prepared by coating, lamination, sequential extrusion, coextrusion or a combination thereof, the laminate formed and its layers will preferably have substantially uniform thicknesses  
35 across the laminate. Laminates prepared in this manner have generally uniform properties with a minimum of

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edge effects such as curl, modulus change, fraying and the like.

After formation, the laminate is stretched past the elastic limit of the skin layer(s), which deform.

5 The stretched laminate is then subjected to localized heat treatment to selectively relax or deactivate the elastic in certain regions or zones. This allows the oriented elastic in the treated regions to locally randomize to form a dimensionally stable elastic

10 material in these regions or zones. The localized heat treatment must be long enough to release stresses in the deformed unstable elastic.

The now localized heat treated laminate is recovered, as discussed above in the non-heat treated,

15 or non-deactivated, regions or zones. For heat-activated recovery, the inherent temperature of heat activation is determined by the materials used to form the elastic layer of the laminate in the first instance. However, for any particular laminate the

20 activation temperature, for example, either  $T_{a-50}$  or  $T_{a-90}$ , can be adjusted by varying the skin/core ratio of the laminate, adjusting the percent stretch or the overall laminate thickness. The activation temperature used for a heat-shrink laminate is generally at least 80°F

25 (26.7°C), preferably at least 90°F (32.2°C) and most preferably over 100°F (37.8°C). When forming a heat activatable laminate, the stretched and locally heat treated laminates are quenched on a cooling roller, which prevents the heat generated during elongation

30 from prematurely activating laminate recovery in the remaining activated regions. The chill roll temperature is maintained below the activation temperature.

Fig. 2 is a schematic diagram of the common

35 dimensions which are variable for uniaxially stretched and recovered laminates in the activated or recovered microtextured regions. The general texture is a series



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of regular repeating folds. These variables are the total height A-A', the peak to peak distance B-B' and the peak to valley distance C-C'. These variables were measured for a series of polyolefin/styrene-isoprene-  
5 styrene/polyolefin laminates. General ranges for A-A', B-B' and C-C' were noted. For total height (A-A'), the range measured was from 0.79 to 32 mils(0.02 to 0.81 mm). For peak-to-peak distance (B-B'), or the fold period, the measured range was from 0.79 to 11.8  
10 mils(0.02 to 0.30 mm). For peak-to-valley distance (C-C'), the measured range was from 0.04 to 19.7 mils(0.001 to 0.5 mm).

The elastomeric laminates prepared in accordance with the invention, can also be described in terms of  
15 increase in skin surface area. Where the microtextured laminate shows heavy textures, the surface area will increase significantly. As the stretch ratio increases, so does the percent increase in surface area, from the unstretched to the stretched and  
20 recovered laminate. Generally, the skin surface area will increase by at least 50%, preferably by at least 100% and most preferably by at least 250% in the stretched and recovered areas or regions. The increase in surface area directly contributes to the overall  
25 loft, texture and feel of the laminate surface when microstructured or when the skin detaches from the elastic core.

For those constructions prone to delamination, a brief relaxing or annealing following activation may be  
30 used to counteract this tendency, if desired. This brief annealing step will release residual unstable orientation at the elastomeric layer and skin layer interface, particularly for elastic between folds of the microstructured skin layer. The annealing would  
35 generally be above the glass transition point temperature ( $T_g$ ) of the elastomer, above the B block  $T_g$  for ABA block copolymers, but below the skin polymer

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melting point. A lower annealing temperature is generally sufficient. The annealing will generally be for longer than 0.1 seconds, depending on the annealing temperature, followed by cooling to room temperature in the relaxed annealed state. With commercial ABA block copolymers (e.g., Kraton<sup>TM</sup> 1107), an annealing or relaxing temperature of about 75°C is found to be sufficient. If it is preferred to create delamination of the skin in the elastic regions, this annealing step should be avoided prior to delamination.

Fig. 3 is an example of a film that has been stretched and locally heat treated to create non-elastic deactivated regions 11 and allowed to recover in elastic regions 12. The elastic has been locally heat treated as bands extending transverse to the stretch direction. However, the localized heat treatment and deactivation can extend in bands in the elongation direction, multiple directions or in patterns to create elastics where the localized heat treated deactivated regions or zones can selectively buckle. In Fig. 3, the elastic regions 12 of the elastic laminate 10 have microtextured skin layers.

In some embodiments, the skin layer can be selectively detached in the activated elastic areas 12 to form the elastic regions 12 of Fig. 4 by, e.g., working the film in conjunction with a delaminating heat treatment. This detachment process is dependent on the relative adhesiveness of the skin and core layers and the thickness of the skin and core layers. Additives can be added to the skin and/or core layers to promote delamination, such as polymers or release agents incompatible with the polymer in the adjacent layer that tends to separate the interlayer interface. For example, it has been found that polystyrene and oil added to an A-B block copolymer core promote delamination of polyolefin skin layers, while ethylene

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vinyl acetate or polyalphamethylstyrene added to the polyolefin skin layers also promotes delamination.

Fig. 4 displays the embodiment where the skin layer 13 is selectively detached from the elastomeric core layer 14. In the locally heat-treated non-elastic regions 11, the oriented skin layer 13 remains securely bonded to the elastomeric core layer 14, as well as strengthened due to the orientation and subsequent localized heat treatment. The elastomeric core layer 14 in regions 11 (as in Fig. 3) is thin relative to the elastomeric core layer in elastic regions 12. The detached skin layer 13 in elastic regions 12 provides an attachment surface in the elastic regions 12 while avoiding the above discussed problematic direct attachment of a substrate to the elastomeric layer 14.

The Fig. 4 elastic 20 also provides air channels 15. These channels 15 can provide breathability to elasticized regions of a garment, or the like, such as a cuff or diaper waistband or leg band.

The laminate of Figs. 3 and 4 can be extensively used in disposable diapers, for example as a waistband, located in either the front or side portions of the diaper at waist level, as leg elastic, as an outer cover sheet or in elasticated slip-on diapers or training pants, where the elastomeric laminate could be used as, or in, side panels around the hip that have zones of elasticity to create a tight fitting garment. The laminates can be applied as continuous or intermittent lengths by conventional methods. When applied, a particular advantage of the elastic laminate 20 with delaminated skin (e.g., the Fig. 4 embodiment), is that extremely uniform shirring can be easily obtained by applying elastic laminates with substantially flat non-elastic regions 11 while the elastic regions 12 are stretched. When the elastic regions 12 recover, the Fig. 6 garment layers 18 and 19 will shirr only in those regions with skin

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delamination, i.e. the elastic regions 12, and shirr uniformly in elastic regions 12 (i.e., as a single gather). This allows one to predictably and easily control garment shirring, a property not possible with  
5 conventional film elastics.

Similar uniform shirring can be obtained with the Fig. 3 embodiment by zone release coating the elastic laminate 10 in elastic regions 12. The release coating can be a conventional low adhesion coating or in a  
10 preferred arrangement an oil, such as mineral oil. The oil is preferred due to cost and ease of application. The oil has not been found to migrate when the elastic 10 is wound in a roll form as would be expected for a conventional film. It is believed that oil migration  
15 is arrested by the microtextured skin layer surface in the oil-coated area.

When an elastic laminate with flat non-elastic regions 11 as shown in Figs. 3 and 4, is attached to a garment; as shown in Fig. 6, the elastic also provides  
20 improved elastic stress at low elongations of the elastic laminate 10, versus a continuous elastic film. The elongational stresses in this arrangement are preferentially confined to the elastic regions which proportionally provide increased elastic stress or  
25 force.

The elastomeric laminate can be adhered to a garment by ultrasonic welding, heat sealing and adhesives such as pressure-sensitive adhesives, by conventional methods. The adherence would be  
30 preferably in at least the locally heat treated non-elastic regions 11.

Another use for the invention laminates would be as an elasticized diaper fastening tab as per, e.g., U.S. Pat. No. 3,800,796, as shown in Fig. 5. The  
35 elastic zone 6 can be placed at the desired location while providing selectively deactivated non-elastic end regions 7 and an elastic central region 6. Adhesive 8

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could then be applied to one or more faces of the inelastic end regions 7.

The laminate of Fig. 7 is an example of a suitable construction for use as an outer cover sheet or an elastic panel in an elasticated disposable garment such as a slip-on diaper or training pant using the laminate of Fig. 4. The laminate of Fig. 3 could also be employed in the construction depicted in Fig. 7 (as well as Figs. 8-16). Elastic portions 21 and 23 of the elastic laminate construction 30 would be joined to form elasticated side panels around the hip of the wearer. The non-elastic portion 22 would be formed in a manner similar to non-elastic regions 11 and would be joined to the absorbent pad at an end thereof, preferably to a liquid-impermeable outer cover layer for the absorbent pad. Alternatively, the non-elastic portion 22 could provide the liquid-impermeable outer cover layer on the absorbent pad structure of the elasticated diaper or training pant. In a preferred arrangement, the elastic laminate 30 further comprises a nonwoven layer 24 attached to at least one face of a laminate providing reinforcement and softness to the elastic material.

Fig. 8 illustrates a possible construction employing an elastic laminate, such as described in Fig. 7, or versions using the Fig. 3 elastic laminate, with or without nonwoven layers laminated thereto. The laminate 40 would be in the form of a continuous web which would be cut into discrete units such as shown in Fig. 8 optionally provided with elastic 44 and 43 to provide waist elastication for the disposable garment. The garment would further be converted by cutting out portions 41 and 42 to provide for the legs of a wearer.

An alternative embodiment is depicted in Fig. 9 where an additional non-elastic region 51 and 52 is provided on the outer edges of the elastic portions 21 and 23 as sealable strips. The Figs. 8 and 9 laminates

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can be formed into a garment such as shown in Fig. 10, which can be of a construction such as shown in Fig. 11 where the outer side edges 61 or 62 of the laminates 40 or 50 would be sealed at a side seam 63 to form a pant-type garment with elastic side panels formed by joining of the elastic portions 21 or 23. An absorbent pad would be placed adjacent the non-elastic region 22 of the laminate, which would further be covered by a conventional liquid-permeable inner layer or topsheet 65, which could also cover the inner face of the elastic laminate 40 or 50. The absorbent 64 can be applied to the laminate by any conventional means including the use of a hot-melt adhesive which can also be used to attach the topsheet 65.

15 An alternative embodiment for employing a laminate, such as shown in Fig. 7, in a disposable diaper or training pant, is depicted in Fig. 12. In this embodiment, the absorbent pad is sandwiched between the liquid-permeable topsheet 65 and a liquid-impermeable cover sheet 66 to form a composite structure 60. The central non-elastic region 22 of a strip of an elastic laminate, such as shown in Fig. 7, is then attached to a first front end 74 portion of the pad composite structure 60, preferably to the liquid-impermeable outer sheet 66. The outer longitudinal side edges 71 and 72 of the elastic regions 21 and 23 are then attached to the opposite back end portion 75 of the pad composite structure 60 at attachment region 73 by conventional means. The side edges 71 and 72 can be elastic or non-elastic, however, preferably are non-elastic to enhance adhesion. The side edges 71 and 72 can be adhered to either the outer face of the nonwoven topsheet 65, or the liquid-impervious outer sheet 66, or sandwiched therebetween. Preferably, edges 71 and 72 are attached to the outer face of the liquid-impervious outer sheet 66, as shown in Fig. 12. The width of the elastic panel 70 would preferably be

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similar to the width of laminates 40 and 50 along the longitudinal seams 63, as shown in Figs. 10 and 11. Alternatively, non-elastic region 22 can be attached to the opposite back end portion 75 of the absorbent pad composite 60 with the edges 71 and 72 attached to a first front end 74 of the pad composite 60.

Figs. 13 and 14 (elastic band 80 is enlarged to show detail) display an alternative embodiment where the elastic composite is releasably or resealably attached to a front portion 81 of an absorbent pad composite 60. The absorbent pad composite 60 is provided with leg elastics 86 and 87 and waist elastic 88 and 89. The non-elastic region 22 of an elastic band 80 is attached to the liquid-impervious outer cover sheet 64 at a back end 75 of the absorbent pad composite 60. At the outer side edges of the elastic regions 21 and 23 are provided attachment regions 82 and 83, which preferably are non-elastic. On the attachment regions 82 and 83 are provided a pair of first attachment means 85 and 84, respectively, which releasably attach to one or more second complementary attachment means 81 at a front end 74 of the absorbent pad composite 60. The first attachment means 84 and 85 can be a conventional attachment means such as a pressure-sensitive adhesive patch, a mechanical fastener patch or a cohesive adhesive patch. A fastening tab could also be used (not shown) where the tab is permanently attached to the attachment regions (82 or 83) at one end and provided with the attachment means (84 or 85) at a distal end. A complementary attachment means 81 would comprise a region suitable matched to the pressure-sensitive adhesive on attachment regions 82 and 83 (such as a plastic landing strip or otherwise reinforced portion of the liquid-impervious backsheet 64, if necessary). Zone 81 would also include a mechanical fastening element complementary to the mechanical fastening elements on

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85, or a suitable matched cohesive adhesive. Although less preferred, an elastic laminate band 80 can also be releasably attached to the rear end 75 of the absorbent pad 60 with the non-elastic region 22 permanently  
5 adhered to the front end 74 of the absorbent pad 60.

Figs. 15 and 16 (elastic band 90 is enlarged to show detail) display an alternative version of a detachable and resealable pant design employing an elastic laminate band 90 provided with a fastening tab  
10 91 as the attachment means. The fastening tab 91 is permanently adhered at a first end 93 to an attachment region 92 of the elastic laminate band 90, which region is preferably non-elastic. This permanent attachment can be achieved by conventional means such as adhesive  
15 bonding, heat sealing or ultrasonic welding. The distal end 94 of the fastening tab 91 would be provided with a suitable attachment means to releasably engage with the outer face of the opposing elastic portion (21 or 23) of the elastic band 90. Either of the opposing  
20 elastic portions can also be provided with a fastening means (e.g., a pressure-sensitive adhesive patch or tab to engage the absorbent pad composite). Preferably, this attachment means on the distal end 94 would comprise male mechanical fastener elements, which would  
25 releasably engage with a nonwoven or foraminous material laminated to the outer face of the elastic band 90, such as shown in Fig. 7. Pressure-sensitive adhesive could also be used on the distal end 94 of fastening tab 91 as the attachment means.

30 A further embodiment of the invention is an anisotropic film that will be non-elastic on a first axis and elastic or extensible on an axis orthogonal to the first axis. The film non-elastic axis is provided by stretching an elastic laminate, then subjecting the  
35 entire stretched laminate to a deactivating heat treatment rather than merely a localized deactivating heat treatment. The skin layer will then be oriented



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and strengthened in the direction or axis of stretch and substantially non-extensible on this axis.

However, the film in the orthogonal or cross direction will be readily extensible or elastic, if subsequently

5 stretched and allowed to recover. This anisotropic quality renders this film particularly well suited to applications where a film is desired that is strong in one direction yet conformable in the cross direction. For example, a sealing pressure-sensitive adhesive tape  
10 to be applied to an uneven surface such as a pipe fitting or screw threads is advantageously conformable in the cross direction to sealingly engage all surfaces, despite their variation in diameter, yet strong in the longitudinal direction.

15 The following Examples are provided to illustrate presently contemplated preferred embodiments and the best mode for practicing the invention, but are not intended to be limiting thereof.

## 20 Examples

A continuous coextrusion process was carried out to prepare three layer film laminates having two outer inelastic skin layers and an elastomeric core layer. One extruder was used to feed the elastomeric core  
25 layer material and a second extruder was used to feed the inelastic skin layer material into a three-layer Cloeren<sup>TM</sup> feedblock, and the resulting layered melt was extruded through a single manifold film die and cast onto a cast roll. Feedblock and die temperatures ranged  
30 from approximately 400 - 540 deg F (204 -282 deg C) and the cast roll temperatures ranged from approximately 70 - 180 deg F (21 - 82 deg C). Line speeds averaged approximately 30 feet (9.14 m) per minute. Film laminate total thicknesses ranged from 3 - 10 mils (0.076 -  
35 0.254 mm) and core to skin (C/S) ratios varied from 4:1 to 10:1. Film compositions, feedblock and die

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temperatures, cast roll temperatures, C/S ratios and total film thicknesses (in mils) are given in Table I.

A localized heat treatment was used to create non-elastic regions or zones on the elastic laminates. A three inch (7.62 cm) wide sample of film was first stretched in the transverse direction (TD) at a ratio of from about 3:1 to 6:1 and then was passed over a patterned heated roll which resulted in parallel longitudinal bands of inelastic regions running in the machine direction (MD) of the film. Heating temperatures ranged from about 150 - 180 deg F (66 - 82 deg C).

A cyclical stretching and heating process was used to affect delamination of the outer inelastic skin layers from the elastomeric core layer in the elasticized regions of the film laminates. A 1.0 inch x 3.0 inch (2.54 cm x 7.62 cm) sample (MD by TD) of film was stretched in the transverse direction to just before break (95 - 150%), which activated the locally non-heat treated regions. The film was then placed in a stream of hot air supplied by a heat gun (approximately 140 deg F or 60 deg C). The film was heated until the elasticized regions were fully contracted and warmed (< 1 minute). The film was then removed from the heat and was stretched by hand in the transverse direction until just before break, and then immediately allowed to recover. The film was heated once again (< 1 minute), then was cyclically stretched and immediately released, in the transverse direction. This heating and stretching process was repeated until an observation of delamination or no delamination could be made. Delamination occurring after 3 - 10 cycles was considered excellent. The extent of delamination was evaluated visually and was classified as no delamination (0), delamination difficult (1), good delamination (2), delaminates easily, or excellent (3),

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and delaminates very easily (4): Delamination observations are given in Table II.

TABLE I

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10

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20

Ex.	Skin Composition	Core Composition	Additives in Core	C/S Ratio	Film Thickness (microns)	Feed-block & Die Temp. °F (°C)	Cast Roll Temp. °F (°C)
1	PP 3085	K-1657	NONE	10	3(76)	450 (232)	80 (27)
3	PP 1024	K-1657	NONE	10	3(76)	450 (232)	72 (22)
3	PP 1024	K-1657	10% PS-G3	7	3(76)	450 (232)	80 (27)
4	PP 1024	K-1657	10% PS-666	7	3(76)	450 (232)	120 (48)
5	PP 1024	K-1657	15% PS-666	7	3(76)	450 (232)	120 (48)
6	PP 1024	K-1657	20% PS-666	7	3(76)	450 (232)	120 (48)
7	PP 1024	K-1657	10% PS-615	5	3.5(89)	450 (232)	180 (82)
8	PP 1024	K-1657	10% PS-615	7	3.5(89)	450 (232)	180 (82)
9	PP 1024	K-1657	10% PS-615	7	3.5(89)	450 (232)	120 (48)
10	PP 1024	K-1657	10% PS-615	7	3.5(89)	450 (232)	80 (27)
11	PP 1024	K-1107	10% PS-615 + 1% IRGANOX 1076	5	3(76)	400 (204)	80 (27)
12	PP 3445	K-1107	10% PS-615 + 1% IRGANOX 1076	5	3.3(84)	420 (216)	70 (21)
13	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	411 (211)	80 (27)
14	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	435 (224)	80 (27)

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5	15	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	460 (238)	80 (27)
	16	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	480 (249)	80 (27)
	17	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	500 (260)	80 (27)
	18	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	520 (271)	80 (27)
	19	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5.5	3.5(89)	540 (282)	80 (27)
	20	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	7	3(76)	420 (216)	70 (21)
	21	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	7	3(76)	480 MELT (249)	70 (21)
	22	PP 3085	K-1107	10% PS-615 + 1% IRGANOX 1076	5	3(76)	480 MELT (249)	70 (21)
	23	PP 1024	K-1657	5% MINERAL OIL	7	3(76)	450 (232)	80 (27)
	24	PP 3085	K-1107	5% MINERAL OIL + 1% IRGANOX 1076	7	2.5(64)	420 (216)	70 (21)
10	25	LDPE 4012	K-1107	10% PS-615 + 1% IRGANOX 1076	7	2.5(64)	420 (216)	70 (21)
	26	HDPE 52053	K-1107	10% PS-615 + 1% IRGANOX 1076	7	2.5(64)	420 (216)	70 (21)
	27	PP 1024	K-1657	10% PS-615	5	3.5(89)	450 (232)	120 (48)
	28	90% PP 1024 + 10% EVA 260	K-1657	10% PS-615	5	3(76)	450 (232)	120 (48)

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29	PP 3085	K-1107	10% PS- 615 + 1% IRGANOX 1076	5	3(76)	450 (232)	70 (21)
30	95% PP 3085 + 5% EVA 260	K-1107	10% PS- 615 + 1% IRGANOX 1076	5	3(76)	450 (232)	70 (21)
31	PP 3085	K-1657	10% PS- 615 + 1% IRGANOX 1076	5	3(76)	450 (232)	64 (18)
32	95% PP 3085 + 5% EVA 260	K-1657	10% PS- 615 + 1% IRGANOX 1076	5	3(76)	450 (232)	64 (18)
33	90% PP 3085 + 10% PAMS 18-29	K-1107	10% PS- 615 + 1% IRGANOX 1076	5	3(76)	450 (232)	70 (21)
34	PP 3085	PU 2102- 75A	NONE	5	3(76)	435 (224)	80 (27)

Tensile and elongation data (ASTM D-638 and D-412) were obtained on the samples using an Instron 1122 Tensile Tester (available from Instron<sup>TM</sup> Corporation). A 0.5 inch x 3.0 inch (1.27 cm x 7.62 cm) sample was placed at a 2.0 inch (5.08 cm) gauge length and was stretched at a rate of 12 inches (30.5 cm) per minute. The tensile and elongation data are given in Table II.

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TABLE II

Ex.	Delami- nation	Tensile Stress (MD) PSI at Break (N/cm <sup>2</sup> )	Elongation (MD) % at Break	Tensile Stress (TD) PSI at Break (N/cm <sup>2</sup> )	Elongation (TD) % at Break
5	1	574 (396)	903	690 (476)	818
	2	767 (529)	859	666 (459)	844
	3	2446 (1687)	800	3018 (2081)	793
	4	2801 (1931)	901	2592 (1787)	823
	5	2973 (2050)	886	2961 (2042)	863
10	6	2498 (1722)	766	2243 (1547)	816
	7	2352 (1622)	697	3263 (2250)	722
	8	2586 (1783)	820	3526 (2432)	847
	9	2514 (1733)	843	3160 (2179)	812
	10	2351 (1621)	817	2502 (1725)	793
15	11	2137 (1473)	739	1884 (1299)	706
	12	1818 (1254)	878	1114 (768)	615
	13	1893 (1305)	809	1828 (1260)	695
	14	1796 (1238)	772	1969 (1358)	757
	15	1841 (1269)	834	1777 (1225)	737
20	16	1796 (1238)	868	1256 (866)	601
	17	1755 (1210)	878	1664 (1147)	781
	18	1353 (933)	868	1144 (789)	611
	19	1440 (993)	770	1112 (767)	559
	20	1209 (834)	670	1389 (958)	857

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5	21	4	1476 (1018)	812	1338 (923)	849
	22	3	1442 (994)	732	1286 (887)	766
	23	2	1407 (970)	754	1928 (1329)	812
	24	4				
	25	2				
10	26	4				
	27	1	1883 (1298)	680	2514 (1733)	729
	28	3	2484 (1713)	753	2904 (2002)	727
	29	3	1661 (1145)	800	1511 (1042)	863
	30	4	1602 (1105)	794	1566 (1080)	901
15	31	1	2555 (1762)	808	2124 (1464)	756
	32	2	2666 (1838)	828	2541 (1752)	773
	33	4	1878 (1295)	873	1199 (827)	775
	34	2	3132 (2160)	589	1343 (926)	355

The following abbreviations are used in Table I to indicate the materials used in the skin and core layers.

20 PP 3085 is Escorene™ 3085, a 36 MFI polypropylene available from Exxon Corporation.

PP 3445 is Escorene™ 3445, a 35 MFI polypropylene available from Exxon Corporation.

25 PP 1024 is Escorene™ 1024, a 12 MFI polypropylene available from Exxon Corporation.

LDPE 4012 is low density polyethylene #4012 available from Dow Chemical Company.

HDPE 52053 is high density polyethylene #52053 available from Dow Chemical Company.

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K-1657 is Kraton™ G-1657 a styrene-ethylene-butylene-styrene (SEBS) block copolymer available from Shell Chemical Company.

K-1107 is Kraton™ 1107 a styrene-isoprene-styrene (SIS) block copolymer available from Shell Chemical Company.

PU 2102-75A is Pellathane™ 2102-75A, a polyurethane available from Dow Chemical Company.

PS-G3 is polystyrene #G3 available from Amoco Oil Company.

PS-666 is polystyrene #666 available from Dow Chemical Company.

PS-615 is polystyrene #615 available from Dow Chemical Company.

EVA 260 is Elvax™ 660, an ethylene-vinyl acetate copolymer available from I.E. duPont de Nemours Company.

PAMS 18-290 is poly(alphamethylstyrene) #18-290 available from Amoco Oil Company.

Irganox™ 1076 is an anti-oxidant available from Ciba-Giegy Corporation.

Amoco™ White mineral oil #31USP is mineral oil available from Amoco Oil Company.

Examples 1 and 2 are film laminates having two outer inelastic layers of polypropylene and a elastomeric core layer of a styrene-ethylene-butylene-styrene (SEBS) block copolymer. Two different polypropylenes were used. The inelastic skin layers delaminated from the elastomeric core layer in the elasticized regions of the film laminate having PP 3085 as the inelastic skin layers but delamination was difficult. No delamination was observed for the sample having PP 1024 as the inelastic skin layers.

Examples 3 - 12 show that the addition of a stiffening aid, polystyrene, to the elastomeric core layer promotes delamination.



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Examples 4 - 6 are examples of the effect of varying the amount of polystyrene added to the elastomeric core. No significant effects on the delamination characteristics or elastic properties of the film laminates were observed by varying the amount of polystyrene from 10 - 20 weight percent. In Examples 8 - 10 the cast roll temperature was varied from 80 - 180 deg F (27 - 82 deg C). Raising the cast roll temperature above 120 deg F (49 deg C) did not influence delamination.

Examples 13 - 19 are film laminates having two outer inelastic layers of PP 3085 polypropylene and an elastomeric core layer of a styrene-isoprene-styrene (SIS) block copolymer having 10 weight percent polystyrene in the core. The skin layers easily delaminated from the elastomeric core layers for these samples. These examples also demonstrate that increasing the feedblock and die temperatures does not influence the delamination properties of the film laminates.

Examples 7, 8, 21 and 22 show that film laminates having a higher core-to-skin ratios (7:1) delaminate more readily than those with a lower core-to-skin ratios (5:1).

Examples 23 and 24 show the effect of adding mineral oil to the elastomeric core. These samples delaminated more readily than samples having elastomeric cores without any oil additive.

Examples 25 and 26 are film laminates having two outer inelastic layers of polyethylene and an elastomeric core layer of a styrene-isoprene-styrene (SIS) block copolymer having 10 weight percent polystyrene in the core. The use of high density polyethylene and low density polyethylene as the skin layers was investigated. The skin layers easily delaminated from the elastomeric core layers for these samples.

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Examples 27 - 32 show that the addition of 5 and 10 weight percent of an ethylene vinyl-acetate copolymer to polypropylene skin layers promotes delamination. A comparison of Examples 29 and 30 to 5 Examples 31 and 32 also shows that delamination occurs more readily when the elastomeric core is a styrene-isoprene-styrene block copolymer than it does when the core is a styrene-ethylene-butylene-styrene block copolymer.

10 Examples 29 and 33 show that the addition of 10 weight percent of poly(alphamethylstyrene) to polypropylene skin layers promotes delamination.

Example 34 is a film laminate having two outer inelastic layers of polypropylene and a polyurethane 15 elastomeric core layer. This sample showed good delamination characteristics.

#### Example 35

An elastic film laminate sample having the 20 following features was prepared in a manner similar to Example 11:

	Skin composition:	PP 1024
	Core composition:	K-1107
25	Additives in core:	20% PS G-18 <sup>1</sup> and 0.5% Irganox <sup>TM</sup> 1010 <sup>2</sup>
	C/S ratio:	7.25
	Film thickness:	2.5 mil (62.5 micron)

30 <sup>1</sup> Amoco polystyrene #1-G18-C7 available from Amoco Oil Company

<sup>2</sup> antioxidant available from Ciba-Geigy Corporation

35 The film laminate was stretched in the transverse direction at a ratio of about 6:1 and was then passed over a patterned heated roll (88°C). This resulted in alternating parallel longitudinal bands of inelastic and elastic regions (approximately 1.5 mm in width) 40 running in the machine direction of the film. A

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cyclical stretching and heating process as described above was used to affect delamination of the outer inelastic skin layers from the elastomeric core layer in the elasticized regions of the film laminate.

5       The film laminate was then stretched 100% in the transverse direction and a nonwoven web typical of that used for disposable diaper coverstock (17 g/m<sup>2</sup> basis weight point-bonded spunbond polypropylene) was laminated to one side of the film laminate through the  
10 use of an acrylate-based adhesive transfer tape (#950 available from 3M Company).

Machine direction tensile strength data was obtained for the elastic film/nonwoven laminate using an Instron<sup>TM</sup> 1122 tensile tester. The test was a  
15 modified version of ASTM D-882. A 1 in x 3 in (2.54 cm x 7.62 cm) sample was placed at a 2.0 in (5.08 cm) gauge length and was stretched at a rate of 20 in (50.8 cm) per minute. Six samples were tested. The data ranged from 5300-6000 gms/in (2.09 - 2.36 Kg/cm) width  
20 at 35-45% stretch. For comparison, tensile strength data was obtained for a typical diaper backsheet material, 1.5 mil (37.5 micron) thick polyethylene film (available from Clopay). Values ranged from 1188 gms/in (0.47 Kg/cm) width at 400% stretch to 1960 gms/in (0.77  
25 Kg/cm) width at 730% stretch.

#### Example 36

An approximate 8 in<sup>2</sup> (20.3 cm<sup>2</sup>) piece of the elastic film laminate prepared above in Example 35 was  
30 stretched to 100% in the transverse direction and a center longitudinal zone measuring 4 in (10.2 cm) in width was subjected to a deactivating heat treatment (approximately 93°C for one minute). This resulted in a film sample with an inelastic center region having  
35 adjacent elasticized regions on both sides of the center zone.

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We claim:

1. An elastic film laminate comprising a continuous elastomeric core layer of at least a first  
5 thickness and at least one continuous inelastic skin outer layer of oriented plastic having a second thickness less than the first thickness, characterized in that the film laminate divided into at least one elastic region and at least one non-elastic region, the  
10 elastomeric core layer in the non-elastic region having a thickness less than said first thickness when the elastomer is in the relaxed state and in substantially continuous planar contact with the at least one outer skin layer, the elastomeric core layer in the at least  
15 one elastic region having said first thickness and having an overlying skin layer having an outer surface area greater than the planar surface area of the elastomeric layer in the elastic region in the relaxed state.

20

2. The elastic film of claim 1 further characterized in that the overlying skin layer in the at least one elastic region is at least in intermittent contact with the elastic layer.

25

3. The elastic film of claim 2 further characterized in that the skin layer and elastic layer in the at least one elastic region are in substantially continuous contact.

30

4. The elastic film of claim 1 further characterized in that the ratio of the first thickness to the second thickness is at least 3.

35

5. The elastic film of claim 1 further characterized in that the ratio of the first thickness to the second thickness is at least 5.

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6. The elastic film of claim 5 further characterized in that the total of the first and second thickness, for all the layers, is at least 1 mil.

5

7. The elastic film of claim 5 further characterized in that the total of the first and second thickness, for all the layers, is at least 2 mils.

10

8. The elastic film of claim 5 further characterized in that the total of the first and second thickness, for all the layers, is less than 10 mils.

9. The elastic film of claim 1 further characterized in that the skin layer and core layer in the at least one elastic region are detached.

10. The elastic film of claim 9 further characterized in that the at least one skin layer is a polyolefin.

11. The elastic film of claim 10 further characterized in that the at least one elastomeric layer is a block copolymer elastomer having elastomeric blocks of a conjugated diene.

12. The elastic film of claim 10 further characterized in that the at least one elastomeric layer is a polyurethane.

30

13. The elastic film of claim 11 further characterized in that the conjugated diene is isoprene.

14. The elastic film of claim 13 further characterized in that the elastomeric layer further comprises 0 to 20 percent of a polystyrene polymer.

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15. The elastic film of claim 11 further characterized in that the elastomeric layer conjugated diene comprises ethylene-butylene and the elastomeric layer further comprises 5 to 20 percent of a  
5 polystyrene polymer or 2 to 10 percent of an oil.

16. The elastic film of claim 11 further characterized in that the skin layer comprises polyethylene or polypropylene blended with 2 to 20  
10 percent ethylene vinyl acetate or 0 - 20% polyalphanethylstyrene.

17. The elastic film of claim 9 further characterized in that the inelastic region is  
15 substantially flat and the skin layer is oriented in a first direction with the film laminate being elastic, in said elastic regions, in said first direction.

18. The elastic film of claim 1 further  
20 characterized in that the inelastic region is substantially flat and the skin layer is oriented in a first direction with the film laminate being elastic, in said elastic regions, in said first direction.

25 19. The elastic film of claim 1 further characterized by a pressure sensitive adhesive layer.

20. The elastic film of claim 1 further characterized by a low adhesion backsize layer on said  
30 skin layer in the elastic regions.

21. The elastic film of claim 1 further characterized by a low adhesion backsize layer on said skin layer in the elastic regions wherein said low  
35 adhesion backsize layer comprises an oil.

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22. The elastic film of claim 19 further characterized in that the pressure-sensitive adhesive is in the non-elastic region.

5           23. The elastic film of claim 22 further characterized by a low adhesion backsize layer on said skin layer in the elastic region.

          24. An anisotropic film laminate comprising a  
10 continuous elastomeric core layer and at least one continuous inelastic skin layer of uniaxially oriented plastic, characterized in that the film laminate is substantially inelastic in the direction of orientation of said at least one skin layer said skin layer being  
15 unoriented in a direction transverse to said direction of orientation such that the laminate is extensible in said transverse direction.

          25. The anisotropic film laminate of claim 24  
20 further characterized in that said laminate is elastic in said transverse direction.

          26. The anisotropic film laminate of claim 24 further characterized by a tape further comprising a  
25 pressure sensitive adhesive layer.

          27. A disposable garment comprising an absorbent core structure having an absorbent core, a liquid-permeable inner layer and a liquid-impermeable  
30 outer layer, and elastic side panels formed by an elastic film laminate comprising a continuous elastomeric core layer of at least a first thickness and at least one continuous inelastic skin outer layer of oriented plastic having a second thickness less than  
35 the first thickness, characterized in that the film laminate is divided into at least one elastic region and at least one non-elastic region, the elastomeric

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core layer in the non-elastic region having a thickness less than said first thickness when the elastomer is in the relaxed state and in substantially continuous planar contact with the at least one outer skin layer, 5 the elastomeric core layer in the at least one elastic region having said first thickness and having an overlying skin layer having an outer surface area greater than the planar surface area of the elastomeric layer in the elastic region in the relaxed state.

10

28. The disposable absorbent garment of claim 27 wherein the elastic film laminate comprises a central inelastic portion (22) and adjacent elastic portions (21 and 23) wherein the central inelastic 15 portion is joined to the absorbent core structure, and the adjacent elastic portions (21 and 23) form the elastic side panels.

29. The disposable absorbent garment of claim 20 28 wherein the central inelastic portion (22) forms the liquid-impermeable outer layer of the absorbent core structure.

30. The disposable absorbent garment of claim 25 29 wherein the elastic portions further comprise non-elastic regions (51 and 52) as a sealable strip at the outer side edges thereof.

31. The disposable absorbent garment of claims 30 29 and 30 wherein the elastic portions provide for leg openings by cutout portions (41 and 42) on each elastic portion (21 and 23).

32. The disposable absorbent garment of any of 35 claims 29-31 wherein opposing outer side edges (61 or 62) of each elastic portion, form a side seam (63) providing two opposing elastic side panels.



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33. The disposable absorbent garment of claim 28 wherein the elastic film laminate is a strip attached at the non-elastic portion (22) to the absorbent core structure at a first end (75 or 74) and  
5 attached to a second opposing end (75 or 74) of the core structure at the outer side edges (71 or 72) of the elastic portions (21 and 23).

34. The disposable absorbent garment of claim  
10 33 wherein the non-elastic portion (22) is permanently attached to the liquid-impermeable outer layer of the absorbent core structure at the first end and releasably attached to the opposing end of the absorbent core structure at the outer side edges (71  
15 and 72) of the elastic portions (21 and 23).

35. The disposable absorbent garment of claim 34 wherein the outer side edges of the elastic portions (21 and 23) are provided with non-elastic attachment  
20 regions (82 and 83), each provided with first attachment means (85 or 84), which releasably attach to a second complementary attachment means (81) at the first end of the absorbent pad structure.

25 36. The disposable absorbent garment of claim 35 wherein the first attachment means comprises a pressure-sensitive adhesive attachment means.

37. The disposable absorbent garment of claim  
30 35 wherein the first attachment means comprises a mechanical attachment means and the complementary attachment means (81) comprises a complementary mechanical attachment means.

35 38. The disposable absorbent garment of claim 35 wherein the first attachment means comprises a cohesive adhesive attachment means and the

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complementary attachment means (81) comprises a complementary cohesive adhesive.

39. The disposable absorbent garment of claim  
5 34 wherein an outer side edge of an elastic portion (21 or 23) is provided with an attachment region (92) provided with a fastener tab 91 which is permanently attached to the attachment region (92) at a first end (93) and provided with a releasable attachment means at  
10 a second distal end (94) to releasably adhere to the opposing elastic portion (21 or 23).

40. The disposable absorbent garment of claim  
39 wherein the releasable attachment means comprises  
15 male mechanical fastener elements, and the elastic band (90) is provided with a nonwoven material adhered to the outer face engagable with the male mechanical fastener elements.

20 41. The disposable absorbent garment of any of claims 28-40 wherein the elastic portions of the laminate are further characterized in that the skin layer and core layer in the at least one elastic region are detached.

25 42. The disposable absorbent garment of any of claims 28-40 further characterized in that the inelastic region is substantially flat and the skin layer is oriented in a first direction with the film  
30 laminate being elastic, in said elastic regions, in said first direction.

43. A method for forming an elastic film  
laminate comprising a continuous elastomeric core layer  
35 of at least a first thickness and at least one continuous inelastic skin outer layer of oriented plastic having a second thickness less than the first

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thickness, where the film laminate is divided into at least one elastic region and at least one non-elastic region, the elastomeric core layer in the non-elastic region having a thickness less than said first

- 5 thickness when the elastomer is in the relaxed state and in substantially continuous planar contact with the at least one outer skin layer, the elastomeric core layer in the at least one elastic region having said first thickness and having an overlying skin layer
- 10 having an outer surface area greater than the planar surface area of the elastomeric layer in the elastic region in the relaxed state, the method characterized by:

- 15 providing a multi-layer laminate of the at least one skin layer and the at least one elastomeric core layer,

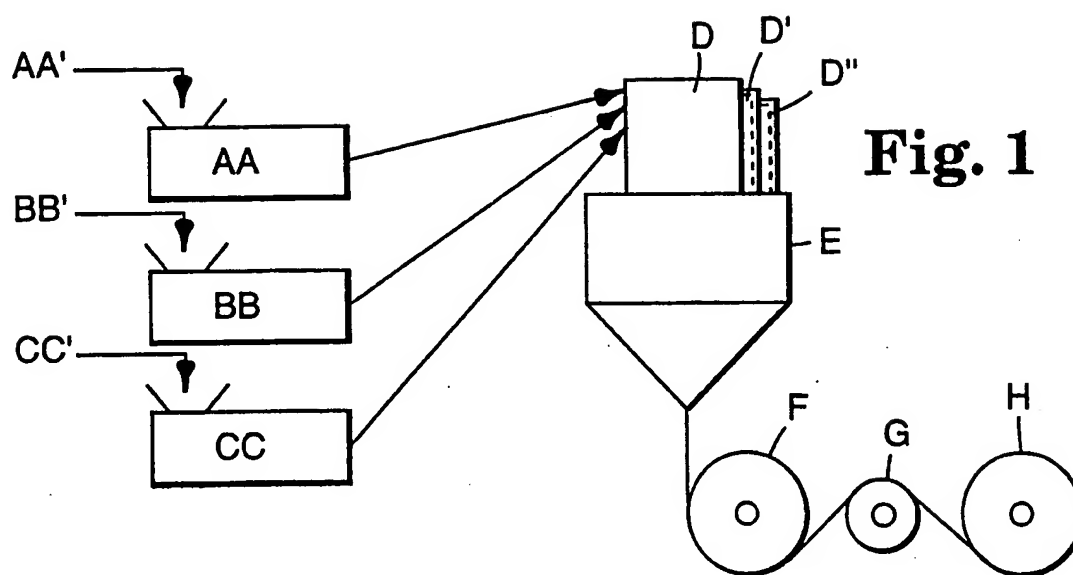
stretching the multi-layer laminate past the elastic limit of the at least one skin layer causing it to deform,

- 20 heating the stretched multi-layer laminate in pre-selected regions randomizing the elastic in these regions, and

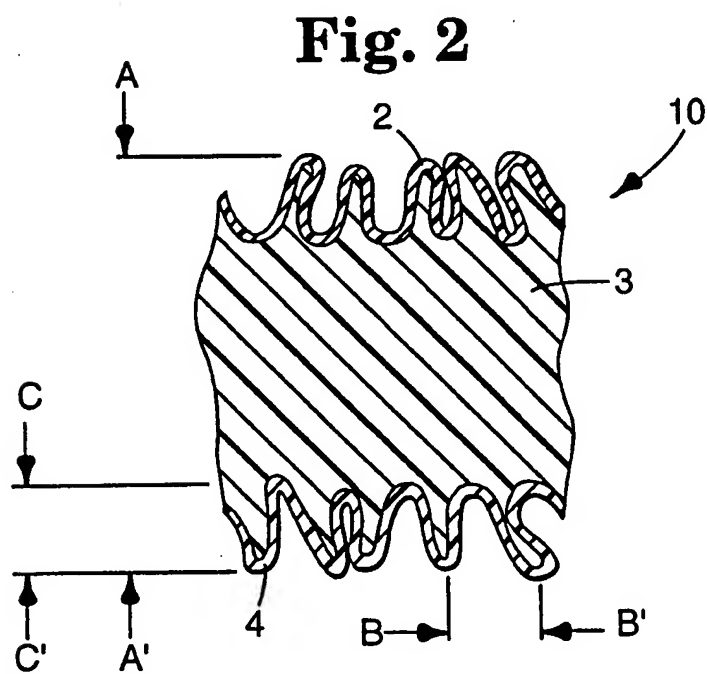
- recovering the stretched multi-layer laminate in the non-heat treated regions to form the elastic regions of the elastic film laminate.
- 25

44. The method of claim 43 further characterized by cooling the stretched laminate prior
- 30 to recovery forming a heat-shrinkable laminate.

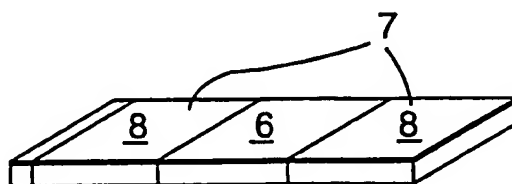
45. The method of claim 43 further characterized by selectively delaminating the skin and core layers in the recovered non-heat treated elastic
- 35 regions of the elastic laminate by cyclical stretching and heating.



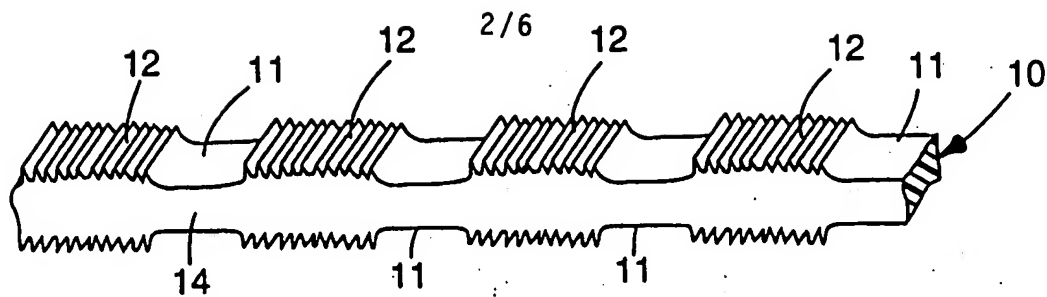
**Fig. 1**



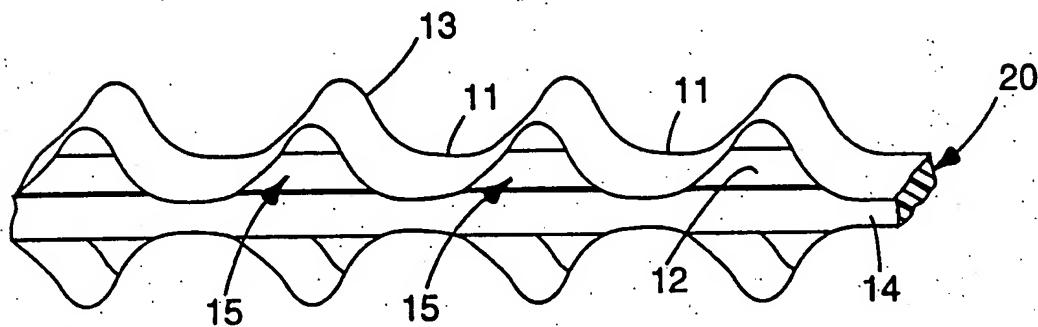
**Fig. 2**



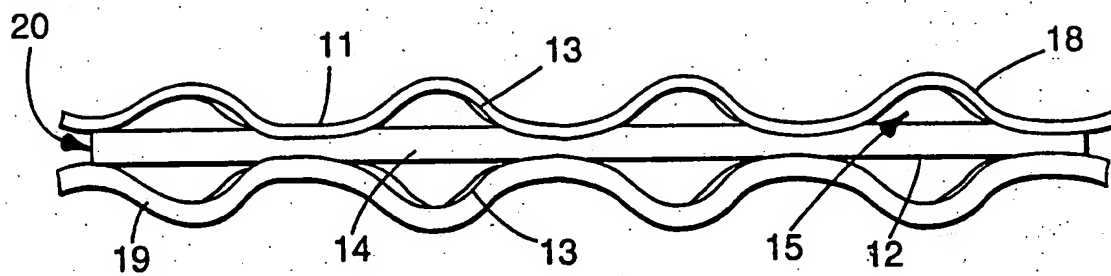
**Fig. 5**



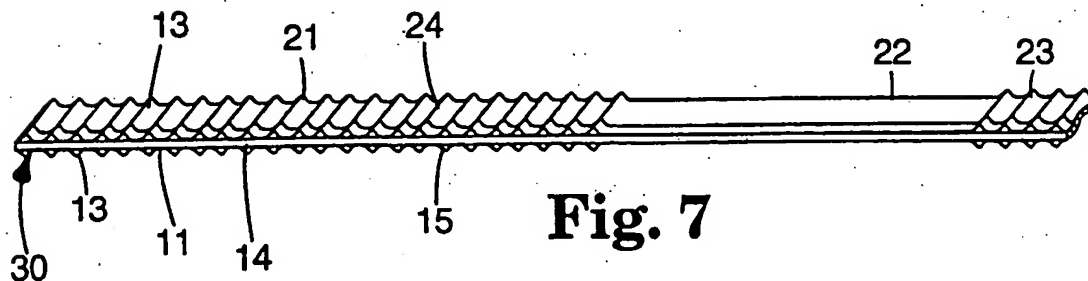
**Fig. 3**



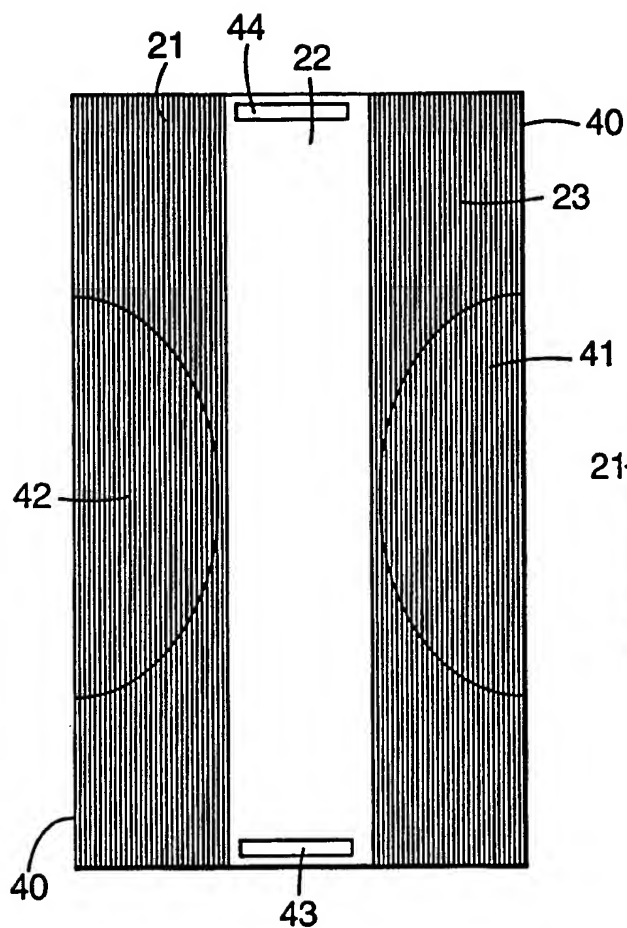
**Fig. 4**



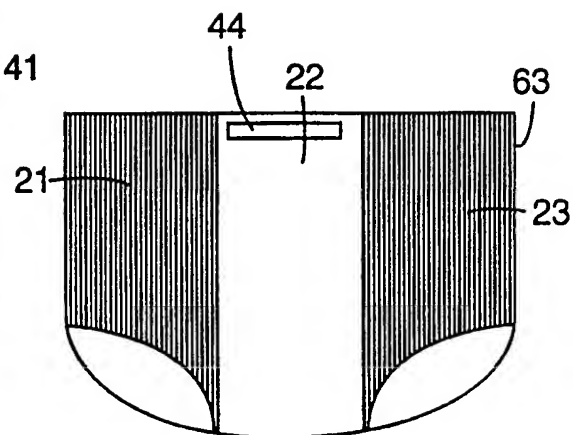
**Fig. 6**



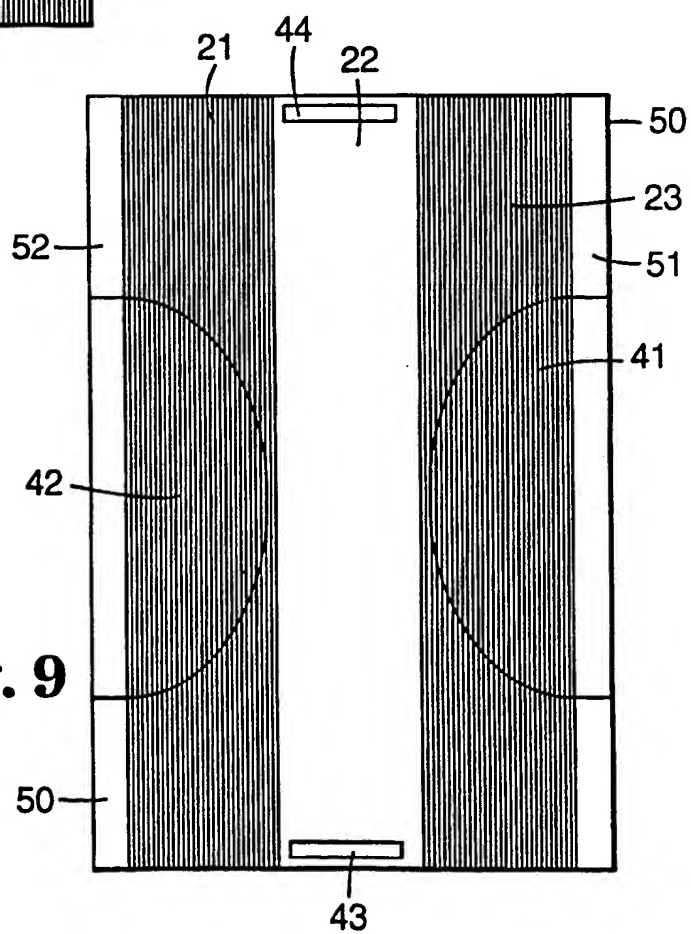
**Fig. 7**



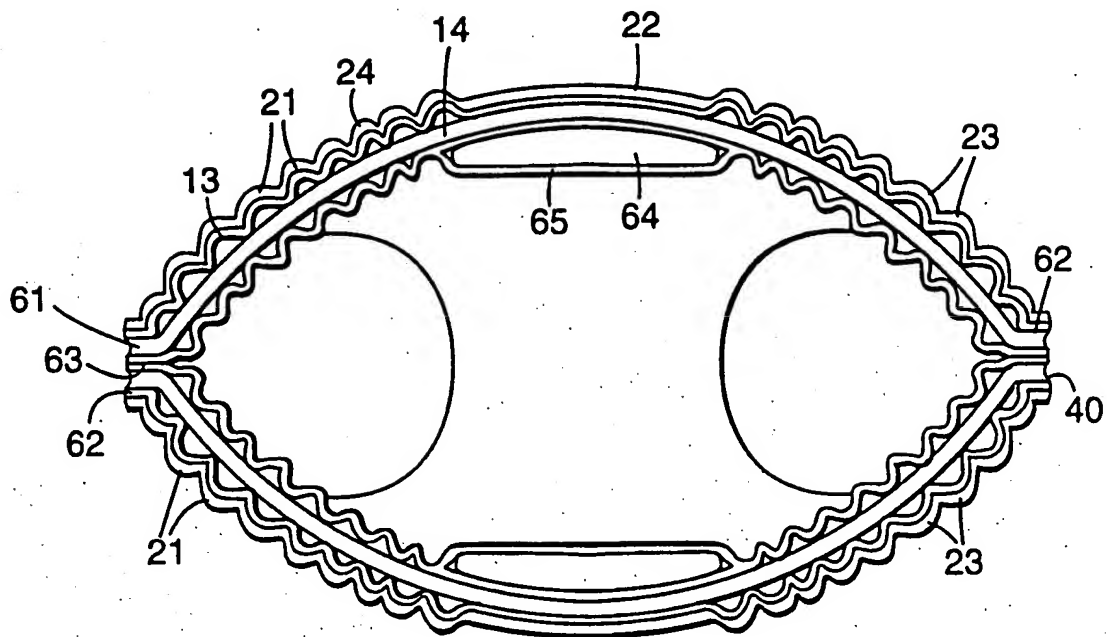
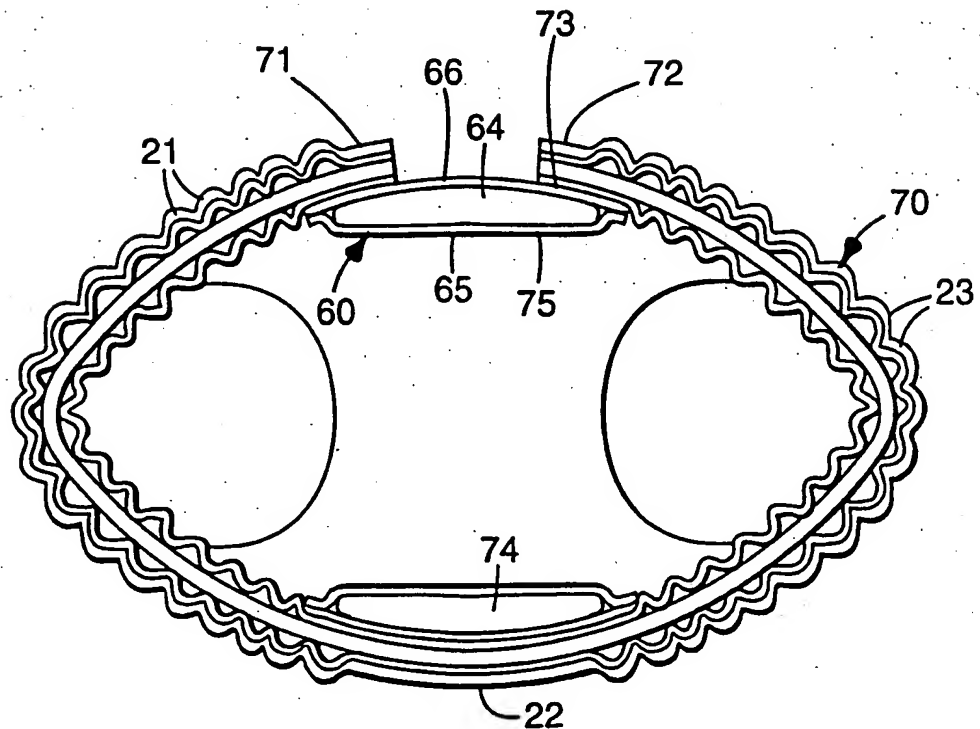
**Fig. 8**

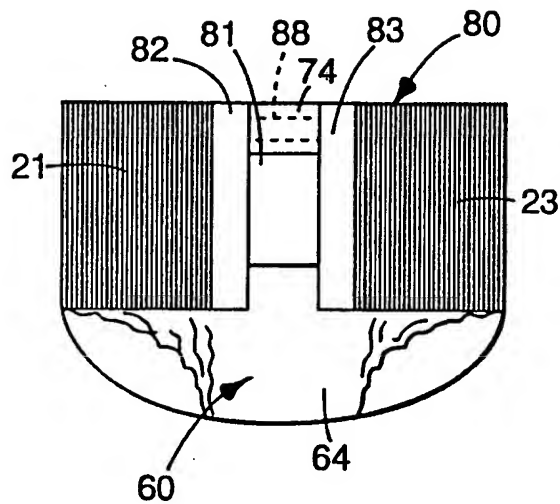


**Fig. 10**

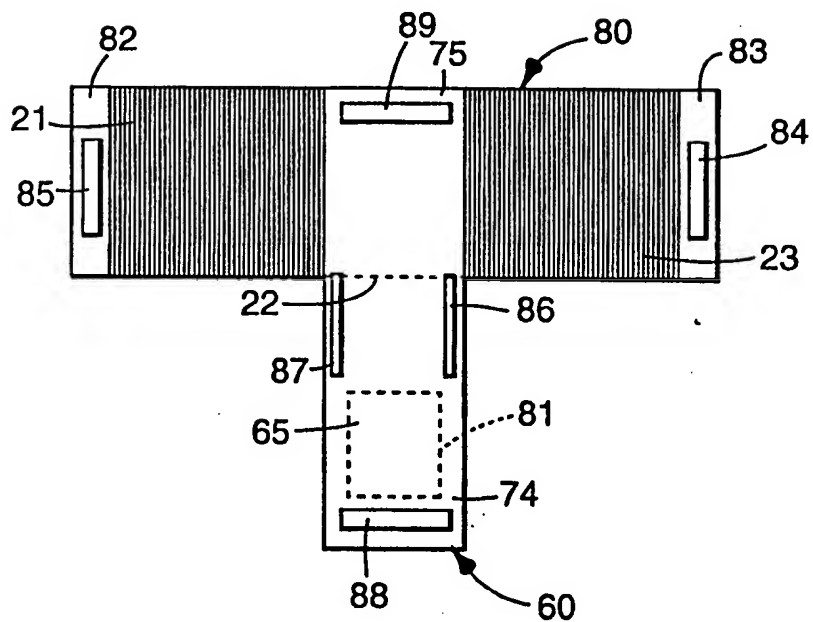


**Fig. 9**

**Fig. 11****Fig. 12**

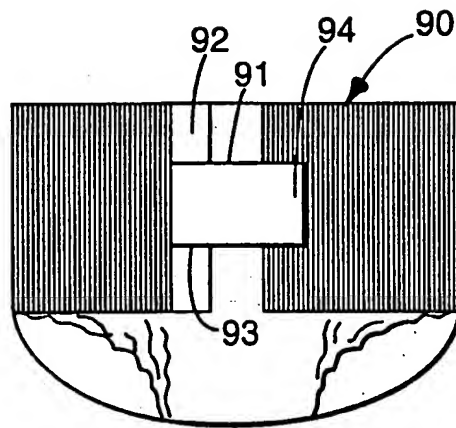
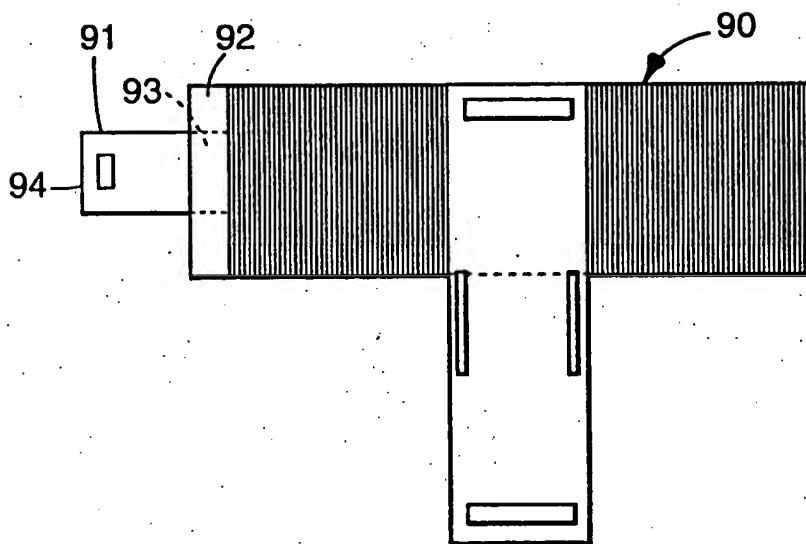


**Fig. 13**



**Fig. 14**



**Fig. 15****Fig. 16**

## INTERNATIONAL SEARCH REPORT

PCT/US 93/05649

International Application No

**I. CLASSIFICATION OF SUBJECT MATTER** (if several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B32B25/08; B32B5/04; B32B5/14; A61F13/15  
 B29C55/02; B29C61/00

**II. FIELDS SEARCHED**Minimum Documentation Searched<sup>7</sup>

Classification System

Classification Symbols

Int.Cl. 5

A61F ; B29C ; B32B

Documentation Searched other than Minimum Documentation  
 to the Extent that such Documents are Included in the Fields Searched<sup>8</sup>

**III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>**

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
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Y		27-43
P,X	WO,A,9 215 446 (THE PROCTER & GAMBLE COMPANY) 17 September 1992 see page 14, line 27 - page 15, line 2; claims 1-13 see page 16, line 27 - page 18, line 30 see page 28, line 17 - page 29, line 3 ---	1,2,3,9, 10,12, 17,18
P,A		16,27
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<sup>10</sup> Special categories of cited documents :

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**IV. CERTIFICATION**

Date of the Actual Completion of the International Search

07 OCTOBER 1993

Date of Mailing of this International Search Report

20. 10. 93

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

PAMIES OLLE S.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
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Y	GB,A,2 244 422 (KAO CORPORATION) 4 December 1991 see the whole document ---	34-40
Y	GB,A,2 064 608 (KIMBERLY-CLARK CORPORATION) 17 June 1981 see the whole document ---	43
A	US,A,4 938 753 (PAUL T. VAN GOMPEL ET AL.) 3 July 1990 see column 1, line 10 - line 13; figures see column 3, line 7 - column 5, line 38 see column 7, line 39 - column 8, line 35 ---	1-23, 27-42
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file on  
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07/10/93

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